U.S. Department of Energy

Tomorrow's Energy Today

for Cities and Counties

Public Utilities Discover Power Blowing in the Wind

Wind is a proven, cost-effective, and environmentally attractive source of power for public utilities around the country. And with recent technological innovations in wind turbine design, more public utility officials are using this vast renewable energy resource.

Wind energy has come a long way. Unlike yesterday's windmill, today's wind turbines include an array of technological innovations that have substantially reduced the cost of electricity from wind and made this power source more attractive to utilities.

Some people think the notion of using wind for electricity blew away years ago. They couldn't be more wrong.

Today, interest in wind power is resurging because of its increased effectiveness and reduced cost. Wind power plants now produce more than 3.1 billion kilowatt-hours (kWh) of electricity each year. That's enough electricity to supply the needs of every household in the state of Montana, with some left over. The cost of electricity from these plants has dropped from an average of $0.07/kWh to about $0.05/kWh (see *Note*, p. 6)—very close to the cost of power from fossil-fuel sources. New wind technologies minimize power fluctuations, control system frequency, and provide better connections to utility networks.

Wind systems increase the power-planning flexibility of utilities. In addition, they operate safely, without pollution, and in harmony with land uses such as farming and ranching. The improving viability of wind energy has not escaped the attention of city and county officials. Public utilities across the country are beginning to include wind in their mix of energy sources.

Warren Gretz / PIX42

Sacramento, California, Breaks New Ground in Wind Energy

In July 1994, the Sacramento Municipal Utility District (SMUD) powered up a new era in wind energy development in the United States. This publicly owned utility finished the first phase of a two-phase, 50-megawatt (MW)

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—Paul Olmstead
Senior Project Manager
Sacramento Municipal Utility District

wind project by bringing a 17-turbine wind power plant on-line to help provide electricity to the district's 1.1 million residents. What's different about this project is that SMUD owns the turbines and the land—4100 acres in the Montezuma Hills of Solano County.

Paul Olmstead, Senior Project Manager at SMUD, says numerous groups from utilities come in to find out why the utility decided to own the project outright. Olmstead says the reason for ownership is simple. "The fuel is free. And the wind is blowing when we need the energy the most. Furthermore, we felt like we had to own it to really make renewables a part of our generation mix," he explains.

Because SMUD is a public utility, it was possible to secure low-interest financing. Olmstead says that by owning the development outright, costs have been lower than they would have been if the utility had purchased power from a wind developer.

SMUD made the decision to add a wind project based on feedback from customers, who wanted the utility to "look for opportunities for renewables," Olmstead says. And SMUD's request for proposals (RFP) for new power generation provided that opportunity. "KENETECH Windpower presented a good portfolio of service in response to our RFP," he says.

SMUD contracted with KENETECH in February 1994 to build, operate, and maintain the $11 million Solano County facility—one of four planned to replace the Rancho Seco nuclear generating station, which is being shut down. The power plant is connected to Pacific Gas and Electric Company's (PG&E's) utility grid, and the power is transmitted back to SMUD. The cost of energy is about $0.05/kWh.

Despite the overwhelmingly positive reaction of customers to this project, SMUD is proceeding with caution. The power plant's performance during the 1994 and 1995 test phase will determine whether the second phase, which will add 150 turbines, will be built. The first 17 turbines must produce 26 million kWh by the end of the 1995 wind season for the second phase to proceed. "We have a lot of issues to deal with, so we're conservative about how we add this power to our utility grid," Olmstead says.

Nevertheless, Olmstead is optimistic. "This project is working out to our advantage and to the wind industry's advantage. I believe this is going to be a very good investment," says Olmstead.

Questions/Answers about Wind

Q: *Why should my community consider wind energy as a source of electricity?*

A: The costs of wind energy at good wind sites are becoming competitive with those of conventional sources of electricity. Wind systems are modular, can sometimes be installed in a matter of months, and can be configured to meet large and small needs for power. They help utilities satisfy regulatory requirements and meet the environmental expectations of customers. Wind systems operate safely and without pollution.

Q: *What will be the effect on the current power system if wind energy is connected to the grid?*

A: Utilities can integrate wind power plants into their system with standard operating techniques using the available control system regulating capacity.

Q: *Do wind turbines have any negative effects?*

A: There have been some bird fatalities at wind development sites. Companies involved in wind power are taking steps to reduce these deaths. People who live near wind sites may dislike the sight of numerous wind turbines. People may also be disturbed by the sound made by turbines. The environmental effects from wind turbines are small compared to those from most other sources of electrical power.

Q: *How can local government officials determine what locations have the best potential for siting a wind power plant?*

A: Municipal utilities can take advantage of national studies, such as those from Pacific Northwest Laboratory (see *For More Information*), and state studies, where available, by placing anemometers, which measure wind speeds, in regions already identified as promising. (To determine if your state has existing studies, contact your state energy office. You can locate your state energy office by contacting the U.S. Department of Energy Regional Support Office [see p. 6] that services your state.) By collecting at least 1 year of data with the anemometers, utilities are able to determine the potential wind resource at their site.

The Goldendale Sentinel / PIX 1109

This Klickitat County, Washington, farmer is one of 5000 residents who'll use electricity generated from a new wind development project. The wind turbines will be placed on the hills in the background.

"The customers think we're doing the right thing."

— Glenn Cannon
General Manager
Waverly Light and Power

Pacific Northwest Taps into Wind

In the state of Washington, a consortium of eight county public utility districts signed an agreement with Bonneville Power Administration and FloWind Corporation to develop a 25-MW wind power plant in Klickitat County, Washington. The consortium, known as the Conservation and Renewable Energy System (CARES), will own the project and sell power back to Bonneville Power Administration.

Ben Wolff, Wind Project Manager for CARES, says that by banding together, the eight public utility districts in the consortium—Benton, Clallam, Franklin, Grays Harbor, Klickitat, Okanogan, Pacific, and Skamania—can take on projects they could not tackle individually.

The wind power plant will use 91 wind turbines purchased from and manufactured by Advanced Wind Turbines Inc. of Redmond, Washington. These 250-kilowatt (kW) turbines were developed by Advanced Wind Turbines Inc. as part of the U.S. Department of Energy's (DOE's) Wind Turbine Development Program. DOE's wind turbine development initiatives help the U.S. wind industry produce competitive, high-performance technology to lower the cost of wind-generated electricity.

Wolff believes the CARES wind power plant will be "a world-class project" and a precursor to more widespread use of wind energy in the Pacific Northwest.

FloWind will build and operate the facility. This wind power plant will provide electricity for 5000 homes when it comes on-line in 1996.

Midwestern City Gives Wind a Try

One midwestern city—Waverly, Iowa—provides a proving ground for wind energy as a source of power for smaller municipal utility grids. In Waverly, city officials "set out to determine if small utilities can own, operate, and maintain wind systems," says Glenn Cannon, manager of Waverly Light and Power. "We've definitely shown that they can."

Waverly brought an 80-kW wind turbine on-line in September 1993 through a contract with Zond Systems, Inc. Cannon says it's working well. And not only that, "The customers think we're doing the right thing," he adds.

The cost for Waverly's turbine installation—$126,976—includes everything from the land lease to legal fees. A $25,000 grant from the American Public Power Association offset project costs. During the first 9 months of operation, the turbine produced 102,857 kWh of electricity.

Although power from the wind turbine currently generates less than 1% of the municipal utility's energy supply, Waverly plans to expand the site through partnerships with other public- and private-sector organizations. In fact, the city has worked

"Our lease agreement has been lucrative both financially and in terms of information we gained from the site."

— William Reichmann
Project Manager
Santa Clara Electric Department

with the University of Northern Iowa to establish a Midwest Wind Energy Center at the site to demonstrate the advantages of wind energy and to provide hands-on training, university classes, and seminars. Five additional turbines are planned for 1995.

Cannon believes the future looks good for wind energy in the Midwest, especially with the recent development of turbines designed for low-wind-speed sites. "Wind is a viable option for municipal utilities," he adds.

Wind Farm Makes Money for Santa Clara, California

The Santa Clara Electric Department has a third-party lease agreement for wind energy development on city-owned land. The agreement provides useful operation information with minimal risk and generates income for the city—about $152,000 in 1994 alone.

Under the lease, Zond owns and operates a 203-turbine wind power plant on 640 acres located in California's famous Altamont Pass, the largest developed wind site in the United States. The wind power plant currently uses wind turbines designed during the early 1980s. Zond pays Santa Clara for leasing the land and sells the wind power to PG&E. The amount of the lease payments varies according to output, which averages 33 million kWh / year.

The lease contains a buyout option for Santa Clara starting in 1998. If Santa Clara purchases the wind power plant, the power will then be transmitted to the city under an existing agreement with PG&E.

When the city first bought the land in the early 1980s, officials were aware of the site's wind energy potential because of a previous statewide study. However, at that time, wind energy development projects were viewed as risky.

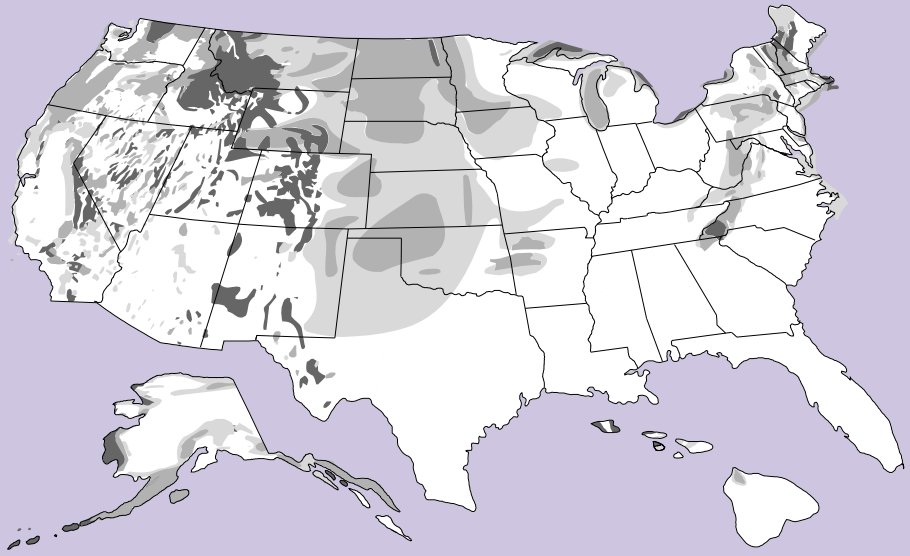
To offset risk, the city decided on a third-party lease agreement for the land in 1984.

"Our lease agreement has been lucrative both financially and in terms of information we gained from the site," says William Reichmann, a Senior Electric Utility Engineer in Santa Clara's Electric Department. In fact, the city has recently signed a lease agreement with Zond for another site that shows promise for wind energy development.

Assessing the Wind Resource in Your Area

This Wind Resource Assessment Map provides national information on moderate, good, and excellent locations for wind energy. Public utilities can determine the wind resource inside their territory with little financial risk by using anemometers to measure wind speeds. Or they can conduct more extensive assessments with help from a new U.S. Department of Energy (DOE) program.

The Utility Wind Resource Assessment Program (U*WRAP) is a collaboration among DOE, Edison Electric Institute, Electric Power Research Institute, and American Public Power Association. The program funds 50% of the cost of wind resource assessments, with a limit of $50,000. To learn more about U*WRAP, contact the Utility Wind Interest Group (see *For More Information*).



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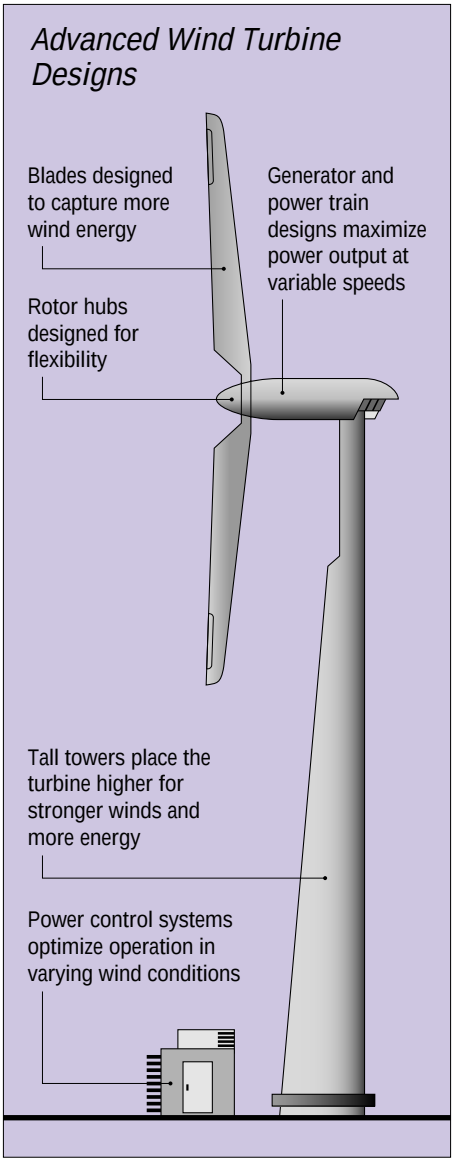

Energy is captured from the wind with wind turbines. The turbines have rotors that usually consist of two or three blades mounted on a shaft. When wind makes the blades spin, the shaft rotates a generator to produce electricity. Because wind speeds are greater farther from the ground (in flat terrain), turbines are mounted on towers—some as tall as 50 meters—to maximize the capture of wind energy.

Making Money Out of Thin Air

Finding a good location with a reliable wind resource is the single best way to ensure lower costs from wind energy. That's why wind resource assessments (see *Assessing the Wind Resource in Your Area,* p. 4) are important for any utility considering adding wind power to the grid. But other methods exist to help decrease the total delivered cost of wind energy.

For example, lowering finance costs provides a second way to reduce the cost of energy from wind. Public utilities often qualify for low-cost financing options. They can also take advantage of other methods such as emissions credits and incentives that lower the total costs of wind energy developments.

Municipal bonds are one low-cost financing option available for municipal utilities. These certificates of debt are appealing to investors because all the interest earned is tax-free. Because municipal bonds are tax-free, financing rates tend to be lower. Both SMUD and CARES used municipal bonds to help finance their wind energy development projects.

Wind energy developers also use accelerated depreciation available through the Tax Reform Act of 1986. Generally, this depreciation allows for a 5-year, double declining balance for wind and other types of renewable facilities.

In addition, wind developers generate revenue by selling tradable emissions allowances or credits. The U.S. Environmental Protection Agency (EPA) awards credits to businesses that have low emissions and allows credits to be traded to businesses with high emissions. Wind energy facilities produce no emissions. The trade helps businesses comply with the Clean Air Act Amendments of 1990 and avoid penalties. Each credit is equivalent to 1 ton of sulfur dioxide for 1 year. In spring 1993, EPA held the first allowance auction, and credits sold for $131 to $200 each.

Owners and operators of wind energy facilities can lower costs even further with the production incentive of $0.015/kWh included in the Energy Policy Act of 1992. Private-sector owners and operators receive the incentive in the form of a federal tax credit. For public utilities, the incentive takes the form of a payment ($0.015/kWh) from the federal government, depending on annual Congressional appropriations. To qualify, facilities must begin operation between January 1, 1994, and June 30, 1999.

Some states offer financial incentives for wind development projects, too. Minnesota provides sales and property tax exemptions for wind energy developers. Wisconsin has created an incentive program that will generate higher profits for investors in utilities that use renewable resources for generating electricity. Check with your state energy office or the American Wind Energy Association (see *For More Information*) regarding your state's incentives.

Conclusion

During the past decade, the wind industry has consistently improved its energy production, financial performance, technological status, and reliability. Because of this industry's steady technological improvement, financial analysts predict a substantial growth in the worldwide market for wind technology. Electric Power Research Institute estimates that wind energy can grow from 0.1% in 1993 to as much as 10% in 2020 of this country's electrical energy. City- and county-owned utilities, like investor-owned utilities, can capitalize on this vast resource to meet growing needs for energy. ■

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American Public Power Association
2301 M Street, NW
Washington, DC 20037-1484
(202) 467-2900
APPA can provide information on the use of wind-generated power in publicly held utilities.

American Wind Energy Association
122 C Street, NW, Fourth Floor
Washington, DC 20002-2109
(202) 383-2500
AWEA can provide information on the use of wind energy for utility applications across the country.

National Renewable Energy Laboratory
Technical Inquiry Service
1617 Cole Boulevard
Golden, CO 80401
(303) 275-4091
NREL operates the National Wind Technology Center, a facility devoted to research and development of efficient wind technologies.

Utility Wind Interest Group
J. Charles Smith, Coordinator
111 Wilson Boulevard, Suite 323
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(703) 351-4492
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UWIG supports the appropriate integration of wind technology for utility applications and can give information to utilities interested in wind energy development.

Pacific Northwest Laboratory
P.O. Box 999
Richland, WA 99352
(509) 375-2789
Fax (509) 375-6731
PNL can provide information about national wind resource assessments.

DOE Regional Support Offices

The DOE Office of Energy Efficiency and Renewable Energy reaches out to the states and private industry through a network of regional support offices. Contact your DOE regional support office for information on energy efficiency and renewable energy technologies.

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(206) 553-1004
(AK, ID, OR, WA)

Note: According to Susan Hock, the Wind Energy Program Manager at the National Renewable Energy Laboratory, the average cost of electricity from wind in 1990 was $0.07/kilowatt-hour. In 1994, that cost dropped to $0.05/kilowatt-hour at sites with annual average wind speeds of 13 miles per hour (6 meters per second).

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